COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION
BUREAU OF CONSTRUCTION & MATERIALS

Inspection of Fabricated Structural Steel

PUB 135 (2-08)
PART 1: INSPECTION OF FABRICATED STRUCTURAL STEEL

SECTION I – INTRODUCTION

The purpose of this publication is to outline general guidelines for the consultant inspectors to carry out the requirements of the inspection agreement. These guidelines are generally written in the imperative mood. In sentences using the imperative mood, the subject “The Inspector(s)” is implied. Also implied in this language are “shall” or “shall be”, or similar words and phrases. The word “will” generally pertains to the decisions or actions of the Department and/or Structural materials Engineer (SME) or his representatives.

Details in the following sections are intended to illustrate the more important and typical aspects of the inspection requirements. Do not construe them as being all-inclusive. The inspection work done by the inspectors may be monitored at any time by an authorized representative of the Department. The Structural Materials Engineer (SME) or his representative shall be given the opportunity to interview the Project manager and his staff.

SECTION II – GENERAL REQUIREMENTS

1. Work Day:

   Seek approval of the SME for work in excess of 7.5 hours per shift when inspection is anticipated due to either occasional or extended production shifts. Contact the supervisor or a regional Engineer in the structural Materials section promptly to justify the action. Take a half-hour break at a midway point during each regular shift. A shift is any continuous work period.

2. Sampling and Testing:

   Witness all required tests, inspections, examinations and reports, sign and date the same. Reinspect, collect samples, and make any special tests or reports when deemed necessary by the SME. Document your actions in the narrative fields of the EQMS program.

3. References and Equipment.

   Equip each shop inspector’s office with the following references and equipment:
   
   - Up-to-date Publication 408 and supplements.
   - Publication 135
   - Publication 35 (Bulletin 15)
   - Special Provisions (supplied by the fabricator)
   - Addenda or requirements.
   - Applicable AWS/AASHTO welding code(s)
   - Weld size gauges.
- Measuring tapes – 30 meter (100 ft) tape.
- Tempel Sticks.
- Flashlight.
- Magnifying glass.
- Digital camera (specific plants, as designated by the SME)
- Other appropriate tools.

**Additional (paint shops)**
- Dry Film thickness gauge
- Sling psychrometer
- Replica tape
- SSPC VIS comparator

Each of these references and equipment shall be supplied by the inspection agency unless otherwise noted.

4. Documentation:

   Maintain accurate records for each project in sufficient detail so that they may be used to facilitate the investigation of defects in structures that are identified at a later date. Do not accept any material which varies from the plans, drawings, specifications or supplements without the Department’s written approval of the specific variation. Do not approve any deviation from the shop drawings or shop details even when an error is suspected. Report and seek approval from the SME in such an event.

5. Harmonious Relations:

   Be courteous and maintain fair and harmonious relations with shop personnel while diligently attending to the required inspection activities.

6. Inspection Responsibilities:

   Table “A” illustrates the inspection roles and responsibilities

**SECTION III – SHOP INSPECTION**

1. Requirements of the inspector:
   1.1. Assure fabricator’s conformance with their Quality Control Plan. Furnish the Department with the work progress on fabrication process. Promptly approve acceptable materials and reject those that are unacceptable or require corrections in order to conform to specifications.
   1.2. Assure fabricator’s conformance to a PENNDOT - approved NDE Written Practice.

2. Verify that fabrication is in accordance with approved shop drawings, specifications and any other contract requirements.
2.1. The Specifications and/or the Special Provisions (if any, as supplied by the fabricator) provide that approved shop drawings are required before fabrication. Notify the fabricator that any fabrication performed prior to receipt of the approved drawings is being performed ‘at risk’ and may not be accepted. Do not accept such items if they are presented for acceptance prior receipt of the approved shop drawings.

2.2. Use fabricator’s shop drawings when approved shop drawings are not immediately available for items other than those in paragraph 2.1. However, note this in the project narrative. Verify previously completed work using approved drawings when they become available.

2.3. Record the heat number(s) of material used in fabrication. Record the name of the item that will be fabricated from this material (e.g. web, flange, angle, cover plate, gusset plate, etc.)

3. Verify that fabrication is performed in accordance with approved welding procedures. Copies of the approved procedures must be in a project file, retained in the inspection office.

4. Verify that shop welders are qualified for the each process and position used, and that copies of their certifications are on file in the inspector’s office.

5. Obtain and verify copies of the materials certifications, including certified mill test reports, welding materials certifications, and others as required by the specifications for all steel and other materials incorporated into the project. Retain those certifications in a project file in the inspection office.

6. Observe the technique and performance of each welder at intervals, to make sure that they conform to the applicable AWS/AASHTO code.

7. Witness the taking of radiographs whenever possible. Verify the joint identification and interpret the radiographs in accordance with welding and radiographic requirements of the construction contract specifications. Verify, sign and date a copy of the radiographer’s report. The fabricator is responsible for submitting radiographs to the SME for final interpretation and retention.

8. Witness ultrasonic testing whenever possible to assure conformance with applicable specifications and code requirements. Verify, sign and date a copy of the U. T. report and keep it in the project file in the inspection office.

9. Witness and approve magnetic particle inspection after assuring conformity with contract documents. Verify, sign and date a copy of the M.T. report and keep it in the project file in the inspection office.

10. Clearly identify each weld nondestructively tested for structures where identification on the inspection reports is inadequate to define the location or extent of each weld inspected, prepare sketches to aid interpretation of tested welds and to eliminate any ambiguity.

11. Witness heat cambering and heat curving and ensure that the maximum approved temperature is not exceeded. Refer to approved procedures within this publication.

12. Verify that all reamed holes are cylindrical and not oblong and that burrs are removed. Verify that chips or drillings are removed between contact surfaces.
13. Verify that all spliced members and other assembled members are plainly match-marked.

14. Witness and document rotational capacity testing, pre-installation verification testing and final torque verification for shop assembled bolted connections.

15. When directed, sample paint for testing in advance of any painting work in the shop.

16. Check blast profile and cleanliness of metal surface prior to painting. Verify that surfaces remain clean at the time of painting. Verify that primer is applied the same day the metal is cleaned. Document findings and test results.

17. Verify that striping is accomplished when necessary.

18. Perform and record dry film thickness readings for shop applied paint systems at the following frequency. Note that these are inspection frequencies, the fabricator is required to meet the requirements listed in the specifications (refer to Publication 408, section 1060).

18.1. Perform three complete sets of DFT readings that circumscribe girders less than 100 feet in length. Four sets of reading will be taken for girders over 100 feet long

Non-Girder Applications:

The following procedure is applicable only for pieces less than 100 square feet in surface area to be covered.

Perform dry film thickness Quality Assurance readings at a testing frequency of the cubed root of the number of individual pieces in each lot¹ for each coat (See table below). Perform testing on the selected pieces as painted prior to assembly.

Take five (5) spot measurements², spaced evenly over the surface of the piece, on each of the selected pieces. The average of the five (5) spot measurements on any piece shall not be less than the specified coating thickness. In addition, no single spot measurement shall be less than 80% of the specified coating thickness.

If one or more thickness deviations are found during initial testing, inform Quality Control and double the sampling/testing frequency for the suspect lot. If subsequent deviations are found, issue a Quality Report informing Quality Control of the deviations and rejection of the lot pending corrective action by the Fabricator/Coater.

¹Lot- A group of similar size and shape pieces for the same structure with an identical coating system that are coated in a continuous operation.

²Spot measurement- an average of three readings in close proximity to one another.
<table>
<thead>
<tr>
<th>Number of Pieces in Lot</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>1</td>
</tr>
<tr>
<td>3-8</td>
<td>2</td>
</tr>
<tr>
<td>9-27</td>
<td>3</td>
</tr>
<tr>
<td>28-64</td>
<td>4</td>
</tr>
<tr>
<td>65-125</td>
<td>5</td>
</tr>
<tr>
<td>126-216</td>
<td>6</td>
</tr>
<tr>
<td>217-343</td>
<td>7</td>
</tr>
<tr>
<td>343-512</td>
<td>8</td>
</tr>
<tr>
<td>513-729</td>
<td>9</td>
</tr>
<tr>
<td>730-1000</td>
<td>10</td>
</tr>
</tbody>
</table>

19. Verify that only domestic steel is used on Department projects. A mill test report with a statement: “melted and manufactured in U.S.A.” is acceptable. Direct the fabricator to obtain a certified letter from the mills furnishing steel products stating that the steel provided is melted and manufactured in the U.S.A., when mill test reports leave any doubt as to origin. Steel provided by a company with a domestic address does not guarantee that it is domestic.

20. Unless otherwise directed, perform final inspection of each item at the time of shipment. Affix acceptance stamp on each accepted item just prior to shipment. Use indelible ink for stamping.

SECTION IV – REPORTS

All inspection activities are required to be recorded electronically using the latest version of EQMS “Electronic Quality Management System” Provided by the Department. New inspectors are required to receive training from the department unless otherwise approved by the Chief Structural Materials Engineer. New users are required to sign the “AGREEMENT TO AUTHORIZE ELECTRONIC ACCESS TO EQMS” prior to using EQMS.

(Note: Unauthorized use of EQMS by non-registered users will result in disciplinary action by the Department)
SECTION V – INSPECTION OF ARMORED PREFORMED NEOPRENE COMPRESSION DAMS

1. Inspect armored preformed neoprene compression dams, modular expansion dams, in accordance with the approved shop drawings.

2. Verify that the preformed neoprene compression seal has been tested and approved for use by the Department.
   2.1. Verify that the seal ordered and received is the style specified in the special provisions and on the drawings.
   2.2. The seal must be unpacked and laid out in one straight length prior to inspection.
   2.3. Verify that the seal is stenciled with the brand name and lot number.
   2.4. Verify that width is not less than or more than the nominal width by more than 5%. Verify that the measured height is within 6 mm (1/4 inch) of the seal’s nominal height.
   2.5. Inspect the seal for splices, cuts, tears or other damage. Note any irregularities in size or shape. All splices in seals must have prior approval and their location must be shown on the approved shop drawings.
   2.6. Prepare form TR-447, Sample Identification, for seals and lubricants when instructed by the SME.

3. Verify that the dam surfaces in direct contact with the seal have been properly cleaned of all paint and foreign material before installation of seal.
   3.1. Verify that the seal is thoroughly cleaned of all dirt, wax or surface bloom prior to application of lubricant-adhesive.
   3.2. Assure that lugs are installed at depths according to the seal manufacturer’s recommendations.
   3.3. Verify that the seal is not stretched during installation.
   3.4. Verify that excess lubricant-adhesive that extrudes from the joint is removed.
   3.5. Direct any seal damaged during installation to be removed and replaced with a new seal.
   3.6. Verify that dams are properly supported for shipping.
PART 2: FORM OF INSPECTION REPORTS

SECTION I – FORM TR-4220 C, INSPECTION CHARGES

Each inspector is responsible for providing a complete and accurate record of inspection activity and charges. Project specific time charges and applicable expenses must be recorded in EQMS.

SECTION II – ELECTRONIC REPORTING – SHOP REPORTS

1. General
   All reporting is to be completed in EQMS unless otherwise directed. The following information is intended primarily to provide general guidance in describing the reporting functions in EQMS and the Department’s direction for your role in providing Quality Assurance inspection. This information is not intended to replace the specific instruction provided in the User Guide/Help Topics of EQMS.

2. Narrative:
   There are two narrative types in EQMS – Plant Narratives and Project Narratives. Plant narratives are those activities which are general in nature and do not pertain specifically to an individual inspector or which pertain to all projects. Examples may include equipment calibrations reviewed, description of visitors, etc. The Project narrative is a description of those activities associated only with a specific project.

   Narratives are expected to be brief and concise, but must provide a basic accounting of the quality assurance oversight activities performed or witnessed, not just a recordation of deficiencies. For example:

   - Describe the major items of inspection during the period of inspection.
   - Identify any problem(s) and the action(s) taken or desired. Follow-up on problems previously reported until resolved. Note final dispositions.
   - Note attached correspondence, indicating date received, if appropriate.
   - Note when shop drawings are not approved. Follow-up daily until they are approved.
   - Note when unapproved welding procedures being used.
   - Note any change in welding procedures, requalification or qualification of new welders.
   - Note when Department approved repairs are performed.
   - Note when inspection for stored materials payment is performed.
   - Note when materials are sampled.
SECTION III – REPORTING

1. **Sample Identification**: Use hardcopy Department Form TR-447 when samples are sent to MTD for testing purposes. Immediately after completing, forward a completed copy of the form to the SME via facsimile or scanned adobe file via e-mail. Periodically check status of sampled materials using EQMS. Notify fabricators of the disposition of sampled materials.

2. **Fabricated Items**: Complete Project Status Record Forms using EQMS. Complete a form for each type of production utilizing all fields which are applicable.

   2.1. **Bearing Status Record**:
     
     2.1.1. Identify the type and piece mark.
     
     2.1.2. Enter the inspector’s initials under each piece mark for each activity and date of inspection.
     
     2.1.3. Record the weight of each piece mark shipped.
     
     2.1.4. Note relevant comments in the remarks field.

   2.2. **Girder Fabrication Project Status Record**:
     
     2.2.1. Identify the piece mark.
     
     2.2.2. Record the inspector’s initials under each piece mark for each activity and date of inspection.
     
     2.2.3. Record the weight of each piece mark shipped.
     
     2.2.4. Note any relevant comments in the remarks field.

   2.3. **Stringer Fabrication Project Status Record**:
     
     2.3.1. Identify the piece mark.
     
     2.3.2. Record the inspector’s initials under each piece mark for each activity and date of inspection.
     
     2.3.3. Record the weight of each piece mark shipped.
     
     2.3.4. Note relevant comments in the remarks field.

   2.4. **Steel Sign Structure – Pole Project Status Record**:
     
     2.4.1. Identify the Item, type and piece mark.
     
     2.4.2. Record the inspector’s initials under each piece mark for each applicable activity and date of inspection.
     
     2.4.3. Record the weight of each piece mark shipped.
2.4.4. Note relevant comments in the remarks field.

2.5. Expansion Dams status Record Form:

2.5.1. Identify the Item, type and piece mark.

2.5.2. Record the inspector’s initials under each piece mark for each applicable activity and date of inspection.

2.5.3. Record the weight of each piece mark shipped.

2.5.4. Note relevant comments in the remarks field.

2.6. Fabrication Status Record for Secondary Items:

Use the form to record the fabrication status for the items listed below:

- Drainage Items
- Grid Flooring
- Posts
- Railings
- Pilings
- Miscellaneous (Diaphragm, Truss Members, Pier Caps, Utility Support, Cross Frames, Diagonal Bracing, and steel Plate)

2.6.1. Identify the Item, type, piece mark, and quantity.

2.6.2. Record the inspector’s initials under each piece mark for each applicable activity and date of inspection.

2.6.3. Record the weight of each piece mark shipped.

2.6.4. Note relevant comments in the remarks field.

SECTION IV – PREAPPROVED REPAIR PROCEDURES FOR STRUCTURAL STEEL MEMBERS

The included procedures are to be used for common repairs on non-fracture critical members. The repair conditions must exactly match the procedure as determined by the Department’s inspector. Any modifications to the procedure must be submitted to the Structural Materials Engineer for evaluation and approval prior to the start of work.
<table>
<thead>
<tr>
<th><strong>TABLE “A” FABRICATED STRUCTURAL STEEL INSPECTION RESPONSIBILITIES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEEL FABRICATION SHOP</strong></td>
</tr>
<tr>
<td>Fabricate structural steel items within framework of</td>
</tr>
<tr>
<td>approved quality control plan in accordance with</td>
</tr>
<tr>
<td>Department specifications</td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
<tr>
<td>− Fabricates in accordance with the Quality control plan</td>
</tr>
<tr>
<td>approved by the Department.</td>
</tr>
<tr>
<td>− Provides a certified Welding Inspector and other quality</td>
</tr>
<tr>
<td>control personnel consistent with the level of production.</td>
</tr>
<tr>
<td>− Conducts non-destructive testing, when required, in</td>
</tr>
<tr>
<td>accordance with the written practice approved by the</td>
</tr>
<tr>
<td>Department.</td>
</tr>
<tr>
<td>− Provides quality products.</td>
</tr>
<tr>
<td><strong>AGENCY INSPECTOR</strong></td>
</tr>
<tr>
<td>Acts as an extension of the Department. Shop operations</td>
</tr>
<tr>
<td>are monitored by agency inspector performing quality</td>
</tr>
<tr>
<td>assurance inspection.</td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
<tr>
<td>− Assures that fabricator is following their approved Quality</td>
</tr>
<tr>
<td>Control Plan.</td>
</tr>
<tr>
<td>− Assures that non-destructive testing is performed by in-</td>
</tr>
<tr>
<td>house personal or outside agencies in accordance with a</td>
</tr>
<tr>
<td>PENNDOT – approved NDE Written Practice.</td>
</tr>
<tr>
<td>− Verifies that material incorporated in product is from</td>
</tr>
<tr>
<td>approved sources. Reviews mill certifications for steel and</td>
</tr>
<tr>
<td>aluminum products.</td>
</tr>
<tr>
<td>− Witnesses the performance of tests and inspections by</td>
</tr>
<tr>
<td>shop Q.C. technicians.</td>
</tr>
<tr>
<td>− Accepts/rejects finished items.</td>
</tr>
<tr>
<td>− Attaches seal pr applies stamp to approve products at time</td>
</tr>
<tr>
<td>of shipping.</td>
</tr>
<tr>
<td><strong>STRUCTURAL MATERIAL FIELD PERSONNEL</strong></td>
</tr>
<tr>
<td>Department personnel overview shops and observe the</td>
</tr>
<tr>
<td>performance of agency inspectors.</td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
<tr>
<td>− Conducts random Independent Assurance shop inspections</td>
</tr>
<tr>
<td>− Assures that agency inspectors meet contract requirements</td>
</tr>
<tr>
<td>and are performing their QA inspection duties according to</td>
</tr>
<tr>
<td>the contract requirements.</td>
</tr>
<tr>
<td>− Samples materials, as required.</td>
</tr>
<tr>
<td>− Accepts/rejects finished item</td>
</tr>
</tbody>
</table>
– Assists in resolving fabrication related problems at project and shop.

**DISTRICT/PROJECT**

Final authority for acceptance/rejection of material at project.

**Responsibilities**

– Provides Notification of Inspection form CS 430 to identify material requiring inspection, fabricator(s) and state project numbers.
– Verifies that items shipped were approved by agency inspector (seal or stamp).
– Visually inspect for damaged items.
– Observes unloading operations by contractor.
– Assures proper storage at project site prior to use.
– Accept/reject finished item.
– Notifies Structural Materials Unit of unacceptable workmanship. Completes TR-800 form when applicable, to document product deficiencies.

**STRUCTURAL MATERIALS STAFF ENGINEERS**

Directs state-wide program to produce fabricated Structural Steel products.

**Responsibilities**

– Provides technical support for fabricated products to the Districts.
– Approves quality control plans, weld procedure specification and repairs.
– Supervises plant/field inspection personnel.
– Provides timely answers to steel fabricators concerning specification requirements or other request for information.
– Reviews specifications updates as needed.
– Works with Districts to resolve fabrication related problems.
PART 3: SAMPLE FORMS

Note: This part does not contain a comprehensive list of inspection forms. Inspection documentation is to be entered directly into EQMS forms, whenever applicable. Most forms provided herein are hardcopy forms. EQMS does include some printer ready forms to facilitate data collection; however, final documentation is to be made within the application.
<table>
<thead>
<tr>
<th>PUB. 408 SECTIONS AND/OR OTHER APPLICABLE AREAS</th>
<th>DESCRIPTION</th>
<th>MATERIAL CODE</th>
<th>MATERIAL CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>THIS CODE IS TO BE USED FOR ALL ALUMINUM BOLTS, NUTS WASHERS &amp; MISCELLANEOUS HARDWARE USED IN A STRUCTURAL APPLICATION.</td>
<td>STRUCTURAL FASTENERS-ALUMINUM</td>
<td>246</td>
<td>BOLT WASHER NUT MISCHW</td>
</tr>
<tr>
<td>1060.2 CLASSIFIED ACCORDING TO APPLICATION ORDER</td>
<td>STRUCTURAL PAINT</td>
<td>306</td>
<td>PRIME INTER TOP</td>
</tr>
<tr>
<td>(2003/2007)1113 – 50 &amp; 60 DURO, PLAIN &amp; LAMINATED BEARING PADS.</td>
<td>BEARING PAD-NEOPRENE Used in prestress conc. bridge construction pl=plain, Lam=laminated</td>
<td>414</td>
<td>50 PL, 60 PL 50LAM, 60LAM</td>
</tr>
<tr>
<td>MATERIAL IS CLASSIFIED ACCORDING TO TYPE SPECIFIED.</td>
<td>BRIDGE SHOE BEDDING Used in prestress conc. Bridge construction</td>
<td>426</td>
<td>TYPE I TYPE II</td>
</tr>
<tr>
<td>1111.02(c), AASHTO BRIDGE SPECIFICATIONS SECTION 27</td>
<td>TELFON</td>
<td>520</td>
<td>FILLED UNFILLED</td>
</tr>
<tr>
<td>THIS CODE IS TO BE USED FOR ALL STEEL BOLTS, NUTS, WASHERS &amp; MISCELLANEOUS HARDWARE USED IN A STRUCTURAL APPLICATION.</td>
<td>STRUCTURAL FASTENERS-STEEL</td>
<td>259</td>
<td>BOLT WASHER NUT MISCHW</td>
</tr>
<tr>
<td>MATERIAL CLASSIFIED BY TYPE OF ANCHOR. EPOXY IS USED TO ANCHOR BOLTS OR DOWELS</td>
<td>ANCHOR BOLT-STEEL</td>
<td>265</td>
<td>WEDGE TIE HOOK WIGGLE EPOXY DROPIN</td>
</tr>
</tbody>
</table>


### Sample Identification

<table>
<thead>
<tr>
<th>Material Code</th>
<th>Material Class</th>
<th>Date Collected</th>
<th>Contract Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>414</td>
<td>50LAM</td>
<td>07312007</td>
<td>E034567</td>
</tr>
</tbody>
</table>

### State Project Number

<table>
<thead>
<tr>
<th>S</th>
<th>SR or W/C</th>
<th>Sp</th>
<th>P</th>
<th>Sec</th>
<th>Org</th>
<th>Program</th>
<th>Cost Endon</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>03012007</td>
<td>001</td>
<td>0930</td>
<td>375</td>
<td>9405</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 403 Year - Section

| 2003 | 1113 |

### TR-447 X-Ref

### QA En

### Project Sample ID

### Location Code

### Place Collected

City and State

### Sampled By

Inspector’s Name

### Telephone Number

7171234567

### Location Information

### Bituminous

<table>
<thead>
<tr>
<th>PTM 740 Density</th>
<th>Design Thickness</th>
<th>Loose/Core TR-447 RCF</th>
<th>Printed Ticket?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes No</td>
</tr>
</tbody>
</table>

### JMF

<table>
<thead>
<tr>
<th>Year</th>
<th>number</th>
</tr>
</thead>
</table>

### Concrete

<table>
<thead>
<tr>
<th>Air</th>
<th>Slump</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Maintenance PD Number

### PE/PEQ

### Remarks

(ANY EXTRA INFORMATION LIKE THE SIZE OR IF THE SUPPLIERS IS NOT A BULLETIN 15 SUPPLIERS THE NAME AND THE ADDRESS IS REQUIRED)
### TEST RESULTS (per 5.19.3.1)

<table>
<thead>
<tr>
<th>Test Category</th>
<th>Maximum Size Single Pass</th>
<th>Minimum Size Multiple Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld Size Acceptable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cracking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thorough Fusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weld Profile per 3.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undercut &gt; 1/32 inch</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Fillet weld soundness tests are required in addition to groove weld PQRs to qualify fillet welds. A fillet weld macroetch text shall be made for each WPS and position to be used in construction. Test Plate D shown in Figure 5.8 of AWS D1.5-2002 shall be used.
**Procedure Qualification Record**

**AWS D1.5-2002**

<table>
<thead>
<tr>
<th>Qualified Per:</th>
<th>5.12.1</th>
<th>5.12.2</th>
<th>5.13</th>
<th>Fabricator</th>
</tr>
</thead>
</table>

**Process**

PQR Prepared by: __________________________

**Position**

1G □ 2G □ 3G □ 4G □ Welder’s name __________________________

**Electrode(s) Mfg. Designation**

AWS Specification __________________________

**Electrode Extension**

AWS Classification __________________________

**Flux Mfg. Designation**

SAW Flux Type: Active □ Neutral □ Alloy □

<table>
<thead>
<tr>
<th>Electrode Dia. (inch)</th>
<th>Current (amps)</th>
<th>WFS* (ipm)</th>
<th>Voltage (volts)</th>
<th>Current &amp; Polarity</th>
<th>Travel Speed (IPM)</th>
<th>Electrode Angle (multi-elec. SAW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<td>3</td>
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</tr>
</tbody>
</table>

*wire feed may be used in lieu of current when a correlation curve is provided for the same electrode diameter and electrode extension.

**Calculated Heat Input (KJ/In)** __________________________

(See AWS D1.5 5.12) AWS Joint Detail used __________________________

**Shielding Gas** __________________________

Flow Rate (cfph) __________________________

Dew Point (°F) __________________________

**Base Metal Thickness (In)** __________________________

Backing Thickness (In) __________________________

**Base Metal Specification & Heat No.**

(Attach Certified Copies of Mill Test Reports)

**Backin Specif. & Heat No.**

(Attach Certified Copies of Mill Test Reports)

**A709 50W carbon equivalent (plate%)** __________________________

(backing%) __________________________

**A709 50W carbon content (plate%)** __________________________

(backing%) __________________________

**Preheat Temp. (°F)** __________________________

Interpass Temp. (°F) Min. __________ Max. __________

**Welding Witness:** __________________________

**Agency:**

**PHYSICAL AND NONDESTRUCTIVE TEST RESULTS**

(Complete below and attach laboratory reports)

<table>
<thead>
<tr>
<th>SPECIMEN</th>
<th>TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Weld Metal Tension (AWMT)</td>
<td>Tensile Strength (psi) __________________________</td>
</tr>
<tr>
<td></td>
<td>Yield Strength (psi) __________________________</td>
</tr>
<tr>
<td></td>
<td>Elongation in 2 in. (%) __________________________</td>
</tr>
<tr>
<td></td>
<td>Reduction in Area (%) __________________________</td>
</tr>
<tr>
<td>Side Bends (accept/reject)</td>
<td>1. _____ 2. _____ 3. _____ 4. _____</td>
</tr>
<tr>
<td>Reduced Section Tension (psi)</td>
<td>Tensile Strength 1. _____ Location of Break 1. _____</td>
</tr>
<tr>
<td></td>
<td>2. _____ 2. _____</td>
</tr>
<tr>
<td>Charpy V-Notch Impact</td>
<td>( _____, _____, _____, _____)</td>
</tr>
<tr>
<td>Toughness of Weld Metal (Ft.lbs.)</td>
<td>Avg. ft.lb. _____ ** @ _____° F</td>
</tr>
<tr>
<td></td>
<td>** Discard the highest and lowest values and average the remaining values.</td>
</tr>
</tbody>
</table>

Physical Tests witnessed by: __________________________

**Agency** __________________________

Expiration Date (5 years for Non Fracture Critical): __________ (3 years for Fracture Critical): __________

I attest that the above information is correct: __________________________ Date: __________________________

(Authorized representative of contractor (fabricator))
Contractor (Fabricator) ___________________________ Welder’s Name ___________________________

Structure Class & Type
- [ ] I Non-Tubular
- [ ] II Tubular

PQR Type: Groove [ ] Fillet: Option 1 [ ] Option 2 [ ] PQR Prepared by: ___________________________

Process(es): GTAW [ ] GMAW [ ] PAW-VP [ ] Position ___________________________

Direction of Welding: Forehand [ ] Backhand [ ] Vertical Upward [ ] Vertical Downward [ ]

AWS A5.10 Filler Classification ___________________________ Filler F-number ___________________________

Initial Cleaning Oxide ___________________________ Initial Dirt & Oil Cleaning ___________________________

Interpass Cleaning ___________________________ Dye Penetrant Removal ___________________________

Bead Type Stringer [ ] Weave [ ] Welding Current ________ Polarity ________ Pulsed ________

Shielding Gas ________ Flow Rate (cfh) ________ Dew Point (°) ________

M Number ________ to ________ Alloy & Temper ________ to ________

Base Metal Thickness ________ to ________ Backing / Type Alloy ________

Base Metal and Backing Specification & Heat Nos. (Attach Certified Copies of Mill Test Reports)

Preheat Temp. (°) ________ Interpass Temp. (°) Min. ________ Max. ________

Postheat treatment [ ] Yes [ ] NO, If yes,

Original Temper ________ Final Temper ________ Temperature ________ Time ________ Quench ________

<table>
<thead>
<tr>
<th>Weld Process</th>
<th>Weld size</th>
<th>Pass No(s)</th>
<th>Electrode Ext.</th>
<th>Electrode Size</th>
<th>Welding Process Variables</th>
<th>Travel Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>AMPS/WFS*</td>
<td>VOLTS</td>
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</tbody>
</table>

* Wire feed speed may be used along with amperage (include chart)

**PHYSICAL AND NONDESTRUCTIVE TEST RESULTS** (Complete below and attach laboratory reports)

Tests for Aluminum Welds

<table>
<thead>
<tr>
<th>Test</th>
<th>Weld size</th>
<th>Contour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual (accept/reject)</td>
<td>1. _________ 2. _________</td>
<td></td>
</tr>
<tr>
<td>Reduced/Full Section Tension (psi)</td>
<td>1. _________ 2. _________</td>
<td></td>
</tr>
<tr>
<td>Root Bend (accept/reject)</td>
<td>1. _________ 2. _________</td>
<td></td>
</tr>
<tr>
<td>Face Bend (accept/reject)</td>
<td>1. _________ 2. _________</td>
<td></td>
</tr>
<tr>
<td>Side Bend (accept/reject)</td>
<td>1. _________ 2. _________ 3. _________ 4. _________</td>
<td></td>
</tr>
<tr>
<td>Nick-Break (Castings) (accept/reject)</td>
<td>1. _________ 2. _________</td>
<td></td>
</tr>
<tr>
<td>Macro weld size (PJP Groove/Fillet)</td>
<td>1. _________ 2. _________</td>
<td></td>
</tr>
<tr>
<td>Fracture (accept/reject) (Fillet)</td>
<td>1. _________ 2. _________ 3. _________ 4. _________</td>
<td></td>
</tr>
</tbody>
</table>

I attest that the above information is correct: ___________________________ Date: ___________________________

(Authorized representative of contractor (fabricator))

17
1. Contractor (Fabricator) ____________________________ Prepared by: ____________________________
   Prequalified ☐ Qualified by testing ☐
   Supporting PQR No(s). ____________________________ ____________________________
2. Material specification(s) ____________________________
3. Material Thickness(es) ____________________________
4. Diameter (pipe) ____________________________
5. Welding process ____________________________
7. Position(s) of welding ____________________________
8. Filler metal specification ____________________________
9. Filler metal Classification ____________________________
   Brand name ____________________________
10. Flux Class ____________________________ Type: Active ☐ Neutral ☐ Alloy ☐
11. Shielding gas ____________________________ Flow rate ____________________________
12. Single pass ☐ Multiple pass ☐
13. Single arc ☐ Multiple arc–Tandem ☐ Multiple arc–Parallel ☐
14. Multiple Electrode Arc Spacing (SAW): Longitudinal _______ Lateral ______
   Angle (degrees) ____________________________ show in joint detail
15. Welding current ____________________________
16. Polarity ____________________________
17. Welding progression ____________________________
18. Root cleaning ____________________________
19. Postheat treatment ____________________________
20. Electrode extension (electrical stickout) ____________________________

<table>
<thead>
<tr>
<th>Weld size</th>
<th>Pass No(s)</th>
<th>Electrode Size (In)</th>
<th>AMPS/WF S*</th>
<th>VOLT S</th>
<th>Travel Speed (IPM)</th>
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</tbody>
</table>

*Wire feed speed may be used along with amperage (include chart)

Preparer’s Signature: ____________________________

Additional Notes: ____________________________

<table>
<thead>
<tr>
<th>Base metal thickness range</th>
<th>Minimum preheat (°F)</th>
<th>Max Preheat &amp; Interpass (°F)</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Joint Detail
Show relevant dimensions and AWS symbols

Preheat and Interpass Temperature Chart
1. Contractor (Fabricator) ___________________________________________ Prepared by: __________________________
2. Referenced PQR No(s). ________________________________________
3. Structure Class & Type I □ II □ Non-Tubular □ Tubular □
4. Base Metal M Num. & Alloy __________________ Temmer __________
5. Base Metal M Num. & Alloy __________________ Temmer __________
6. Base Metal Thickness (es) __________________ To _________________
7. Welding process(es): GMAW _______ GTAW _______ PAW-VP _______
9. Position(s) of welding __________________________________________
10. Filler metal F number __________________________________________
11. Filler metal classification and brand name __________________________
12. Shielding gas _________ Flow rate (cfh) ___________________________
13. Single or multiple pass __________________________________________
14. Polarity _______________________________________________________
15. Welding progression _____________________________________________
16. Stringer _________ Weave _______ Backing Type __________________
17. Root treatment __________________________________________________
18. Postheat treatment □ Yes □ No, If Yes: Original Temper _____________
   Final Temper _________ Temperature _______ Time _______ Quench _____
19. AWS A5.12 Tungsten Electrode Class ______________________________
20. Initial Cleaning: Oxide __________________________ Oil & Dirt _________
21. Interpass Cleaning: Oxide __________________________

<table>
<thead>
<tr>
<th>Weld Process</th>
<th>Pass No(s)</th>
<th>Electrode Ext.</th>
<th>Electrode Size</th>
<th>Welding Process Variables</th>
<th>Travel Speed</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>AMPS/WFS*</td>
<td>VOLTS</td>
</tr>
</tbody>
</table>

*Wire feed speed may be used along with amperage (include chart)

Preparer’s Signature: __________________________

Additional Notes:

<table>
<thead>
<tr>
<th>Preheat and Interpass Temperature Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum preheat (°F)</td>
</tr>
</tbody>
</table>

Joint Detail
Show relevant dimensions, AWS symbols, Welding Sequence
1. Contractor (Fabricator) ____________________________ Prepared by: ____________________________
2. Non-Fracture Critical □ Fracture Critical □ PS Expiration date: ____________________________
3. Qualified in accordance with: 5.11 (prequalified) □ 5.12.1 □ 5.12.2 □ 5.13 □
   Referenced PQR No(s): ____________________________
   Referenced Fillet Weld Soundness Test No(s): ____________________________
4. Material specification(s): ____________________________
5. Material Thickness(es) (range): ____________________________
6. Welding process: ____________________________
8. Position(s) of welding: ____________________________
9. Filler metal specification: ____________________________
10. Filler metal classification and brand name: ____________________________
11. Flux class & brand: ____________________________
    Type: Active □ Neutral □ Alloy □
    Shielding gas ______ Flow rate ______
12. Single pass □ Multiple pass □
13. Single arc □ Multiple arc – Tandem □ Multiple arc – Parallel □
14. Multiple Electrode Arc Spacing (SAW): Longitudinal ______ Lateral ______
    Angle (degrees) show in joint detail
15. Welding current: ____________________________
16. Polarity: ____________________________
17. Welding progression: ____________________________
18. Root cleaning: ____________________________
19. Postheat treatment: ____________________________
20. Calculated Heat Input (KJ/In) Min ___________ Max ___________
21. Electrode extension (electrical stickout): ____________________________

<table>
<thead>
<tr>
<th>Weld size (In)</th>
<th>Pass No(s)</th>
<th>Electrode Size (In)</th>
<th>Welding Process Variables</th>
<th>Travel Speed (IPM)</th>
<th>Joint Detail Show relevant dimensions and AWS symbols</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>AMPS/WF S*</td>
<td>VOLTS S</td>
<td></td>
</tr>
</tbody>
</table>

*Wire feed speed may be used along with amperage (include chart)
Preparer’s Signature: ____________________________
Additional Notes: ____________________________

Preheat and Interpass Temperature Chart

<table>
<thead>
<tr>
<th>Base metal thickness range</th>
<th>Minimum preheat (°F)</th>
<th>Max Preheat &amp; Interpass (°F)</th>
</tr>
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<tbody>
<tr>
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</table>
### Notice of Inspection and Approval of Prestressed Concrete Beams or Fabricated Structural Steel

<table>
<thead>
<tr>
<th>State Project Number</th>
<th>9415</th>
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</thead>
</table>

**Fabricator:**

**Inspection Agency:**

**Inspector Name:**

**Signature:**

**Date:**

#### Fabricated Structural Steel

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Plan Quantity (lb)</th>
<th>Present Request (lb)</th>
<th>Previous Approvals (lb)</th>
</tr>
</thead>
<tbody>
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</table>

#### Prestressed Concrete Beams

<table>
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<tr>
<th>Material Description</th>
<th>Plan Quantity (beams)</th>
<th>Present Request (beams)</th>
<th>Previous Approvals (beams)</th>
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</table>

**REMARKS:**

QUALITY REPORT – FORM TR 443

| Bureau of Construction & Materials - Structural Materials Section | QUALITY REPORT: __________________________ |
|______________________________________________________________|__________________________|
| TR-443 (reproduce locally) | Date: ______________ |

Fabricator/Location: ______________________________ / ______________________________
SR: _______ Section: ______ County ____________________ Contract/Permit No.: ______________
Inspection Agency: ___________________________ Inspector: ______________________________

Product Type / No. Pieces: ______________________________________ / ______________________

Material Type (check one □ ;
□ Prestressed □ Precast □ RC Pipe □ Steel/Bridge □ Steel/Sign □ Steel/Pole □ Timber

Discrepancy Type (check one major heading and all sub-elements that apply □ ;
□ Specification violation □ QC violation □ Product deviation □ Field identified concern

Quality Control Process
□ Unapproved/uncertified technician
□ No QC on operation
□ Fabricated without inspection
□ other, QC

Material
□ Incorrect material used
□ No certification for material
□ Unapproved supplier/subcontractor
□ Finished product out-of-tolerance
□ Unstamped material shipped
□ Deficient concrete strength
□ other, Material

Equipment
□ Incorrect type of equipment used
□ Equipment not calibrated
□ Required equipment not used
□ other, Equipment

Construction Procedures
□ Does not conform to drawing
□ Did not perform procedure (properly)
□ Welding out-of-position
□ Unqualified welder
□ Unapproved repairs performed
□ Safety concern
□ other, Construction

Sampling/Testing
□ Testing frequencies not followed
□ Applicable test method not followed
□ other, Sampling/Testing

Documentation
□ Documentation missing/incomplete
□ Unapproved drawing
□ Unapproved WPS/Mix design
□ other, Documentation

Description of discrepancy:
_________________________________________________________________________________
_________________________________________________________________________________

Company Disposition (check one □ ;
□ Rework □ Repair □ Use ‘as is’ □ Reject □ Other (end product not affected)

Explanation of disposition:
_________________________________________________________________________________
_________________________________________________________________________________

Action taken to prevent recurrent problem:
_________________________________________________________________________________
_________________________________________________________________________________

Company Representative Signature / Date: ________________

Disposition acceptable? : □ (check □ if ‘yes) Disposition resolved and completed? : □ (check □ if ‘yes)

Conditions of acceptance / other comments:
_________________________________________________________________________________
_________________________________________________________________________________

PENNDOT or Inspector Signature / Date: ________________
PAYMENT AUTHORIZATION FOR MATERIAL STORED OR ON HAND – FORM CS-110

S.R.: __________ Sec.: __________ County: __________ District: __________ Date: __________

Project No.: ___________________ Contractor: ___________________ Supplier: ___________________

Storage Location: ☐ On Site (Location)
☐ Vicinity of Project ___________________________ (Location)
☐ Off-Site ___________________________ (Location)

Approval Section:

<table>
<thead>
<tr>
<th>Storage Location</th>
<th>Approval</th>
<th>Disapproval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certification &amp; Shipment, Section 106.03(b)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Storage of Material, Section 106.05</td>
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<tr>
<td>Material Identified &amp; Set Apart</td>
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<td>☐</td>
</tr>
</tbody>
</table>

Attachments:

☐ Contractor’s Letter of Request
☐ Invoices
☐ Material Certifications
☐ CS-439 For Structural Steel or Prestressed Beams
☐ CS-4171 Certificate of Compliance

Reason(s) for Disapproval(s): ____________________________________________________________
__________________________________________________________________________________

Inspected By: ___________________ Signature ___________________ Title ___________________ Date Inspected __________

Item Chart:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Amount Invoiced</th>
<th>Estimated Date of Usage</th>
<th>Item Contract Price</th>
<th>90% Item Contract Price</th>
<th>Amount Payable</th>
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</tbody>
</table>

Total Previously Requested: ___________________ Subtotal: ___________________
25% Current Contract Amount: ___________________ Total Payable: ___________________

Approvals:

Inspector-In-Charge: ___________________ Date: ___________________
Asst. Const. Engr./Mgr.: ___________________ Date: ___________________
Repair of Base Metal Defects for non-fracture critical applications

The following procedure shall be utilized to repair base metal defects on rolled surfaces within the limitations of the applicable AWS D1.5 and ASTM A6 Specifications

1. Grind to bright metal to remove the defective area. The excavation shall be smooth and free of irregularities.

2. Excavations shall be made with a minimum ¼ inch bottom radius. The sides shall slope at a minimum 20-degree included angle and the ends shall slope back at a 45-degree minimum. Attach run-off tabs when necessary. Tack welds are not permitted outside the weld area.

3. Magnetic particle test the area to assure removal of all discontinuities. Inspect both parallel and perpendicular to the length of area to be repaired.


5. Ultrasonic and Magnetic Particle inspection shall be performed as per the applicable sections of AWS D-1.5. Radiographic inspection, in lieu of UT, is required if adjacent holes, appurtenances, etc. preclude acceptable UT inspection.

6. All work shall be performed in the presence of a representative of the Pennsylvania Department of Transportation.

Fabricator Quality Control Representative         PennDOT Inspector Witnessing
Signature: ___________________________            Signature: ___________________________
Heat Camber Procedure
(Rolled Beams and Welded Girders*)

Fabricator Name: __________________________ CMS #: __________________________
SR: _______ Sec: _______ County: ______________ S: __________
Date: __________________________ Location on Piece: __________________________

The following heat cambering procedure shall be used for material with a specified yield strength not greater than 50,000 psi. The heating temperature shall not exceed 1150 degrees Fahrenheit as controlled by temperature indicating crayons.

* NOTE: For welded girders, cut the web to the prescribed camber with suitable allowance for shrinkage due to cutting, welding and heat curving. Camber correction by heating shall be limited to twice the allowable tolerance from the as-planned camber.

Material Specification: ASTM A709 Grade 36, 50 & 50W
Heat Source: Oxy-fuel Heating Torch
Fuel Gas: Optional
Technique: Vee Heating
Single or Multiple Torch: Cambering: Single or Multiple
Heating Temperature: 1000-1150 Degrees Fahrenheit

1. Before heating begins, members to be cambered shall be supported with the web vertical. The flange which will be concaved after cambering shall be placed upward. The member shall also be supported or braced in such a manner as to prevent the member from overturning. Appropriate blocking, as required, shall be used to attain the required tolerance and to prevent excessive movement. (See Sketch #1 for blocking details). Camber tolerances shall be specified by the applicable code and contract specifications i.e. AWS D1.5-2002 Section 3.5, unless otherwise specified. Camber members before heat curving.

2. Heat cambering shall be performed using triangular “V” heating patterns. The heating patterns shall be spaced and marked throughout the length of the member as required to provide the specified camber. (See Sketch #2 for details of the required heating pattern.) Heating shall be performed using an approximately one-inch multi-orifice rosebud tip. Fuel for heating shall be an oxygen-fuel combination. Rosebud tip selection shall be made to promote heating efficiency while minimizing distortion and excessive heating in the web.

3. V-heating shall begin at the apex of the heating pattern. The temperature shall be raised to between 1000 degrees Fahrenheit and 1150 degrees Fahrenheit as rapidly as possible and progress slowly toward the top of the heating pattern. As heating progresses toward the top of the vee, the heating torch shall not be returned to the apex of the heating pattern or to a previously heated area. Heating may be performed either from one side of the web using one torch, or from both sides of the web using two torches. Heat shall not be applied to any previously heated areas on the member.
4. During application of the heat, the heating torches shall be manipulated in a manner as to guard against general and surface overheating. When heating thick material it may be necessary to occasionally interrupt heating for periods of less than one minute to allow the heat to soak into the material and avoid over-heating. At a minimum, temperature indicating crayons for 600, 1000, and 1150 degrees Fahrenheit shall be supplied for verification of the material temperature. Any heating that results in a steel temperature in excess of 1150 degrees Fahrenheit shall be considered destructive and be cause for rejection of the steel. Steel rejected for overheating may be investigated for acceptance, repair, or replacement by means as directed by the Engineer. The cost of the investigation shall be borne by the fabricator.

5. After heating is complete, the member shall be allowed to cool naturally. Artificial cooling using dry compressed air only may be performed after the material has cooled to 600 degrees Fahrenheit. Magnetic particle testing required for the beam or girder shall be performed after all heat cambering is completed.

6. All work described above shall be witnessed by PENNDOT inspector and shall be performed in accordance with AWS D1.5-2002, AASHTO and the latest edition of Publication 408.

Fabricator Quality Control Representative
Signature: _______________________

PENNDOT Inspector Witnessing Procedure
Signature: _______________________

26
SKETCH # 2

V-TYPE HEATING PATTERN DETAIL

DETAIL 1: To be used for cambering

A = 20 degrees max
B = 2/3 Girdle/Beam depth min.
C = 1" min.
D = 10" max.

---

Section AA
Heat Sweep Procedure
(Rolled Beams and Welded Girders)

Fabricator Name: ___________________________ CMS #: ___________________________
SR: ___________ Sec: _______ County: ___________________ S: ______________________

Date: ___________________________ Piece Mark : _____ Radius: □ ≥ 1000 ft □ < 1000 ft

The following heat sweep procedure shall be used for material with a specified yield strength not
greater than 50,000 psi. The heating temperature shall not exceed 1150 degrees Fahrenheit as
controlled by temperature indicating crayons.

Material Specification:ASTM A709 Grade 36, 50 & 50W
Heat Source:Oxy-fuel Heating Torch
Fuel Gas:Optional
Technique:Vee or Strip Heating
Single or Multiple Torch: Single or Multiple
Heating Temperature: 1000-1150 Degrees Fahrenheit

1. Heat member with the web in the vertical position.

2. Before heating begins, brace or support the member in such a manner that the tendency of
the girder to deflect laterally during the heat-curving process will not cause the member
to overturn. Appropriate blocking, as required, shall be used to attain the required
tolerance and to prevent excessive movement. Sweep tolerances shall be specified by the
applicable code and contract specifications, unless otherwise specified. Camber members
before heat curving. Heat shall be applied to adjust the member’s sweep to meet
contractual requirements.

3. Members shall be heat-curved prior to the attachment of end bearing stiffeners, lateral
gusset plates, longitudinal stiffeners, welding of intermediate stiffeners and connection
plates to the flanges, or painting. Longitudinal stiffeners are required to be heat curved or
cut to the required radius prior to being welded to the curved member.

4. Heat application shall be by single or multiple orifice tips only. The size of the tip shall
be proportional to the thickness of the heated material. Fuel for heating shall be an
oxygen-fuel combination. Tip selection shall be made to promote heating efficiency
while minimizing distortion and excessive heating in the member. Heat shall not be
applied to previously heated areas. As a guide, the tip sizes shown in Table 1, are
recommended.

5. Curve members by either continuous or V-type heating. For the continuous method, heat
a strip or intermittent strips along the edge of the top and bottom flange in an essentially
simultaneous manner depending on flange widths and thickness; use a strip of sufficient
width and temperature to obtain the required curvature. (See sketch 1) For the V-type
heating, heat the top and bottom flanges in truncated triangular or wedge shaped areas
having their base along the flange edge and spaced at regular intervals along each flange;
using spacing and temperature as required to obtain the required curvature, and to allow
heating to progress along the top and bottom flanges at approximately the same rate. For
both types of heating, heat the flange edges that will be on the inside of the horizontal curve after cooling. Heat both the inside and outside side flange surfaces if the flange thickness is 32 mm (1 1/4 inches) or greater. Heat the two surfaces concurrently.

6. For the V-type heating, terminate the apex of the truncated triangular area applied to the inside flange surface just before the junction of web and the flange is reached. To avoid unnecessary web distortion, take special care when heating the inside flange surface (the surface that intersects the web) so that heat is not applied directly to the web. When the radius of curvature is 1000 feet or more, extend the apex of the truncated triangular heating pattern applied to the outside flange surface to the juncture of the flange and web. When the radius of curvature is less than 1000 feet, extend the apex of the truncated triangular heating pattern applied to the outside flange surface past the web for a distance equal to one-eighth of the flange width or three inches, whichever is less. For the truncated triangular pattern, provide an included angle of approximately 15 to 30 degrees, but do not exceed 10 inches for the base of the triangle. The flange edges to be heated are those that will be on the inside of the horizontal curve after heating. The heating torch shall not be returned to the apex of the heating triangle after heating has progressed toward the base.

7. Heating shall be confined to the planned and marked patterns. The steel shall be brought to a temperature between 1000 degrees Fahrenheit and 1150 degrees Fahrenheit as rapidly as possible. Temperature indicating crayons manufactured to indicate 600, 1100 and 1150 degrees Fahrenheit shall be utilized. All heat measurements shall be taken after the torch has been removed from the steel. Any heating that results in a steel temperature in excess of 1150 shall be considered destructive and be cause for rejection of the steel. Steel rejected for overheating may be investigated for re-acceptance, repair, or replacement by means as directed. The cost of the investigation shall be borne by the fabricator.

8. Quenching with water or a combination of air and water is not permitted. Cooling with dry compressed air is permitted after the steel has been allowed to cool naturally to 600 degrees Fahrenheit.

9. Magnetic particle testing required for the girder shall be performed after all heat cambering is completed. All nondestructive tests to evaluate damage and any corrective work ordered by the owner to compensate for overstressing shall be performed by the fabricator at no additional cost to the owner.

10. All work described above shall be witnessed by PENNDOT inspector and shall be performed in accordance with AWS D1.5-2002, AASHTO and the latest edition of Publication 408.

Fabricator Quality Control Representative
Signature: ____________________________

PENNDOT Inspector Witnessing Procedure
Signature: ____________________________
SKETCH # 1

CONTINUOUS HEATING PATTERN DETAIL

L = Full length of member or intermittent lengths as required to obtain the specified curvature

W = 1" to 2"
Note: Heating of the top & bottom flanges shall be performed simultaneously.

DIRECTION OF DESIRED MOVEMENT AFTER COOLING
Table 1. Recommended torch tips for various material thicknesses

<table>
<thead>
<tr>
<th>Steel Thickness (in)</th>
<th>Orifice Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; ¼</td>
<td>Single</td>
<td>3</td>
</tr>
<tr>
<td>3/8</td>
<td>Single</td>
<td>4</td>
</tr>
<tr>
<td>½</td>
<td>Single</td>
<td>5</td>
</tr>
<tr>
<td>5/8</td>
<td>Single</td>
<td>7</td>
</tr>
<tr>
<td>¾</td>
<td>Single</td>
<td>8</td>
</tr>
<tr>
<td>1</td>
<td>Single</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Rosebud</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Single</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Rosebud</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Rosebud</td>
<td>5</td>
</tr>
<tr>
<td>&gt; 4</td>
<td>Rosebud</td>
<td>5</td>
</tr>
</tbody>
</table>
Correcting Flange Tilt or Bearing Squaring

Fabricator Name: _______________________________ CMS #: _______________________________
SR: _______________ Sec: _______ County: _______________ S: _______________
Date: _______________________________ Location on Piece: _______________________________

1. Heat shall be applied to the girder to adjust flange tilt or to square the bearing to meet contractual requirements. Heat **shall not** be applied to previously heated areas.

2. All work shall be performed in accordance with AWS D1.5 and the heating process is to be witnessed by the Engineer’s authorized inspector.

3. Heating patterns shall be established as required to correct the flange tilt or bearing square condition.

4. Heating shall be performed using an approximately one inch multi-orifice rosebud tip. Roughly 25 PSI natural gas and 125 PSI oxygen shall be used. Rosebud tip selection shall be made to promote heating efficiency while minimizing distortion and excessive heating to the flange.

5. Girder will be heated with the web in the vertical position.

6. Heating shall be confined to the planned patterns. The steel shall be brought to a temperature between 1000 degrees Fahrenheit and 1150 degrees Fahrenheit as rapidly as possible. Temperature indicating crayons manufactured to indicate 600, 1100 and 1150 degrees Fahrenheit shall be utilized. All heat measurements shall be taken after the torch has been removed from the steel. Any heating that results in a steel temperature in excess of 1150 shall be considered destructive and be cause for rejection of the steel.

7. Quenching with water or a combination of air and water is not permitted. Cooling with dry compressed air is permitted after the steel has been allowed to cool naturally to 600 degrees Fahrenheit.

8. Minor polishing may be required to reduce high spots on the outside surface of the bearing area to achieve a flat and smooth condition after heating.

9. Magnetic particle testing required for the girder shall be performed after all heat cambering is completed.

Fabricator Quality Control Representative  PENNDOT Inspector Witnessing Procedure
Signature: _______________________________  Signature: _______________________________
Repair of Arc Strikes
for Non-Fracture Critical Applications

Fabricator Name: ___________________________ CMS #: ___________________________
SR: ___________ Sec: ______ County: _______________ S: _______________
Date: _______________ Location on Piece: ________________________

1. Grind to bright metal to remove the defective area. The excavation shall be smooth and
   free of irregularities.

2. Magnetic particle test the area to assure removal of all discontinuities.

3. Weld the defect with a qualified welder, using an approved Weld Procedure
   Specification.

4. Magnetic Particle and Ultrasonic testing shall be performed for the repair area.

5. All work shall be performed in the presence of a representative of the Pennsylvania
   Department of Transportation.

Fabricator Quality Control Representative               PENNDOT Inspector Witnessing Procedure
Signature: ___________________________               Signature: ___________________________
**Repair of Gouges in Flame Cut Edges for non-fracture critical applications**

Fabricator Name: __________________________ CMS #: __________________________

SR: ________ Sec: ________ County: __________ S: __________

Date: __________________________ Location on Piece: __________________________

**Gouges 3/16 inch or less in Depth**
(but not exceeding 2% loss of cross section area)

1. These gouges shall be repaired by grinding in the direction of applied stress in the member.
2. Material shall be faired to the material edge with a slope not to exceed one in ten.
   
   Note: Material defects exposed by thermal cutting shall not be repaired as per this procedure.

**Gouges over 3/16” to a maximum of 7/16” deep**
(but not exceeding a length of 1 ½ in. parallel to the member)

1. Grind gouge to bright metal with a bottom radius of 1/4 inch minimum and a 20 degree minimum bevel on sides of gouge.
2. Attach run off tabs with no tack welds outside the repair area. Tack welds must be consumed by final weld.
3. Pre-heat to the applicable minimum temperature and maintain interpass temperature.
5. Remove run-off tabs and grind surfaces smooth and flush. Final grinding shall be parallel to the longitudinal direction of the flange.
6. Ultrasonic and Magnetic Particle Testing shall be performed on all welded burn gouge repairs to the applicable AWS D-1.5-2002 tension or compression code.
7. All work shall be performed in the presence of a representative of the Pennsylvania Department of Transportation.

Note: Material defects exposed by thermal cutting shall not be repaired as per this procedure.

*Note: Approval of these procedures does not supersede any applicable provisions of AASHTO, AWS D1.5-2002 or PennDOT Publication 408.*

Fabricator Quality Control Representative: __________________________

PENNDOT Inspector Witnessing Procedure: __________________________

Signature: __________________________

Signature: __________________________
The following procedure is to be used to remove and replace stiffeners that have been installed and welded:

1. Remove the stiffener by flame cutting to 1/8 inch above the fillet welds.

2. Using air carbon arc, being extremely careful not to damage the web/flange base metal, remove the weld and remaining stiffener to within 1/8 inch of the base metal. Protect the base metal to prevent damage from spatter.

3. Grind the remaining fillet weld/stiffener smooth and flush with the surrounding base metal. Grind parallel to the direction of applied stress.

4. Magnetic particle inspect 100% of the weld removal areas.

5. Fit and weld the replacement stiffener at the detailed location and in accordance with the applicable approved welding procedure specification.

6. All work shall be performed in the presence of the Department’s Quality Assurance inspector.

Fabricator Quality Control Representative				 PennDOT Inspector Witnessing Procedure
Signature: ________________________________

Signature: ________________________________
Quality Control Guidelines for Structural Steel Fabricators

The fabricator will prepare, maintain and follow a Quality Control Plan that describes the roles, activities and procedures associated with executing the minimum quality control requirements listed herein.

The Quality Control Plan may be maintained in electronic format, however, one or more copies of the plan must be maintained by the fabricator's Quality Control Manager in a printed and bound format (3 ring or other). The Quality Control Plan shall be available to all employees. Each document in the plan shall indicate its preparation date and all pages shall be numbered. If a document is revised, the date of revision shall be indicated on the document and recorded in a table of revisions.

The following Quality Control items were adopted from the AASHTO/NSBA Steel Bridge Collaboration, S4.1-2002 ‘Steel Bridge Fabrication QC/QA Guide Specification’.

I. Organization

A. Organization, Certification and Qualifications

1. Describe the level of AISC certification and any other applicable certifications. Include copies of the latest certificates in the Quality Control Plan.

2. Provide an organizational chart that establishes functions, duties, responsibilities, position titles, names and lines of authority.

3. Illustrate a separate chain of command from quality control to Plant Management/Engineering, independent of Production.

4. Identify any Certified Welding Inspector(s) which will oversee welding.

5. List any independent testing laboratories that will be utilized for testing, inspection or qualification

2. Inspection and Testing Equipment

A. Describe the method and frequencies for calibration/verification of welding and testing equipment as per the applicable standards.

1. Include any standard forms used.

3. Control of Raw Materials

A. Describe the method(s) used to inspect incoming materials for conformance to the drawings, plans or specifications.

a. Inspections should include verification that no repairs have been
performed at the producing mill except grinding or welded repairs as allowed in ASTM A6. Fracture critical materials must not include any welded repairs unless authorized in writing by the Owner.

1. Include any forms used.

4. Welding Procedures, Consumables, and Welder Qualifications

   A. Describe the procedure for documenting welder qualifications, Weld Procedure Specifications, and Procedure Qualification Records

   1. Include any standard forms used

      a. Utilize only standard PaDOT forms for PQR, WPS and macro-etch submission and testing. Use a unique and traceable identification number for each.

   B. Describe the process(es) for distribution of the approved WPS to the shop floor and use by production/QC during fabrication.

   C. Describe the procedures used to properly store and handle welding consumables of all types. Include methods for fracture critical materials, if applicable. Include the following:

      a. Use of approved consumables
      b. Warehouse storage, including inventory and stock rotation
      c. Storage in the fabrication shop
      d. Procedures for holding and re-drying SMAW electrodes
      e. Control for time out of storage oven for SMAW electrodes
      f. Drying and recycling of SAW flux
      g. Storage of SAW flux and electrodes
      h. Storage and moisture control for FCAW electrodes
      i. Storage of GMAW electrodes

5. Coatings (If applicable)

   A. Describe the plant’s level of AISC/SSPC paint certification and any other applicable certifications.

      1. Include copies of the latest certificates in the Quality Control Plan.

   D. Describe methods and or procedures used to verify, control and or document the following Identify items which are documented. Include standard forms used:

      1. oil/moisture in air lines
      2. mixing and agitation
      3. monitoring pot life
      4. ambient and steel temperature
      5. relative humidity
6. Nondestructive Examination (NDE)

   A. Submit the written practice used to control and qualify each NDE method
      employed. The written practice must meet the requirements of ASNT-SNT-
      TC-1A.

   E. Identify the certified ASNT Level III personnel for each method.

   D. Identify any ASNT Level II certified employees.

   E. Identify any ASNT Level I certified employees and his/her Level II supervisor.

   Note: When third party services are used for NDE, obtain a copy of that
   company’s ASNT SN-TC-1A written practice and include within the Quality
   Control Manual.

7. Nonconformance Control

   A. Describe the methods and procedures for identifying, controlling and
      disposing of nonconforming materials.

   B. Describe procedures for submitting repair procedures to the Department for
      approval. The following minimum criteria must be included.

       1. State Route, Section and County.

       2. Piece mark, type, size, location and cause (if known) of the defect.

       3. Proposed method(s) for correcting the defect.

       4. NDT method(s) to be utilized.

   Note: Pre-approved repairs listed in Publication 135 do not require prior
   authorization
### LOCATION FOR INSPECTION STAMP

<table>
<thead>
<tr>
<th>ITEM</th>
<th>STAMP FREQUENCY</th>
<th>APPROX. LOCATION OF STAMP</th>
<th>SKETCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sign Structure</td>
<td>Each Tower</td>
<td>Place one stamp on the bottom of the base plate of each tower and one Stamp on the inside hand hole cover for each tower when a hand hole is present.</td>
<td><img src="image" alt="Towers Sketch" /></td>
</tr>
<tr>
<td>Tower</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slider Plate</td>
<td>Each Plate</td>
<td>Place one stamp next to the Fabricators’ ID number for each plate.</td>
<td><img src="image" alt="Slider Plate Sketch" /></td>
</tr>
<tr>
<td>Grid Flooring</td>
<td>Each Section</td>
<td>Place one stamp on the ID tag for each section of grid flooring.</td>
<td><img src="image" alt="Grid Flooring Sketch" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>STAMP FREQUENCY</td>
<td>APPROX LOCATION OF STAMP</td>
<td>SKETCH</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Bearing</td>
<td>Each Bearing</td>
<td>Place one stamp next to the ID number for each bearing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image" alt="Sketch of Bearing" /></td>
<td></td>
</tr>
<tr>
<td>Cross Frames</td>
<td>Each Cross Frame</td>
<td>Place one stamp for each cross frame next to the ID number on the flat plate face.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image" alt="Sketch of Cross Frames" /></td>
<td></td>
</tr>
<tr>
<td>Railings Post</td>
<td>Each Post</td>
<td>Place one stamp next to the ID number for each railing post.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image" alt="Sketch of Railings Post" /></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>STAMP FREQUENCY</td>
<td>APPROX LOCATION OF STAMP</td>
<td>SKETCH</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Railing Post</td>
<td>Each post</td>
<td>Place one stamp next to the ID number for each railing post.</td>
<td></td>
</tr>
<tr>
<td>Pilings</td>
<td>Each Pile</td>
<td>Place one stamp on the web face next to the ID number for each pile.</td>
<td></td>
</tr>
<tr>
<td>Drainage Item</td>
<td>Each Assembly</td>
<td>Place one stamp next to the ID number for each drainage assembly.</td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>STAMP FREQUENCY</td>
<td>APPROX LOCATION OF STAMP</td>
<td>SKETCH</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------</td>
<td>--------------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Sign Structures</td>
<td>Each Section</td>
<td>Place one stamp next to the ID number on the splice plate for each truss section.</td>
<td>![Sketch of Sign Structure]</td>
</tr>
<tr>
<td>Tooth Expansion Dams</td>
<td>Each Piece</td>
<td>Place one stamp next to the ID number for each expansion dam.</td>
<td>![Sketch of Tooth Expansion Dams]</td>
</tr>
<tr>
<td>ITEM</td>
<td>STAMP FREQUENCY</td>
<td>APPROX LOCATION OF STAMP</td>
<td>SKETCH</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------</td>
<td>--------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Light Poles</td>
<td>Each Pole</td>
<td>Place one stamp on the bottom of the base plate of each tower and one stamp on the inside hand hole cover for each tower when a hand hole is present.</td>
<td><img src="image1.png" alt="Light Poles Sketch" /></td>
</tr>
<tr>
<td>Girders and Stringers</td>
<td>Each Girder or Stringer</td>
<td>Place one stamp on the nearside web face next to the ID number for each girder or stringer.</td>
<td><img src="image2.png" alt="Girders &amp; Stringers Sketch" /></td>
</tr>
<tr>
<td>Misc. pieces</td>
<td>Each</td>
<td>Place where practical due to the number of miscellaneous parts, one stamp on each ID Tag, or each individually packaged Item and on the outside surface of each box, can, or pallet.</td>
<td><img src="image3.png" alt="Miscellaneous Items" /></td>
</tr>
<tr>
<td>ITEM</td>
<td>STAMP FREQUENCY</td>
<td>APPROX LOCATION OF STAMP</td>
<td>SKETCH</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------</td>
<td>--------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Miscellaneous Sub assemblies bundled and</td>
<td>Each</td>
<td>Place one stamp on each ID Tag, and so as to be visible after bundling</td>
<td></td>
</tr>
<tr>
<td>strapped</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous Sub assemblies bundled and</td>
<td>Each</td>
<td>See above. Also stamp the exterior of the box</td>
<td></td>
</tr>
<tr>
<td>boxed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Non-Destructive Test Certification Required

The Inspector assigned to a plant with the primary work type should possess the CWI and NDT Level II certification as shown below. Exceptions must be requested by the consultant project manager in advance of the work assignment.

<table>
<thead>
<tr>
<th>Primary Work Type (Specific experience for inspection personnel other than structural steel fabrication noted where applicable)</th>
<th>CWI (Yes, Preferred)</th>
<th>NDT Level II Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girder / Rolled Beams</td>
<td>Yes</td>
<td>MT, UT, [RT][3], Visual</td>
</tr>
<tr>
<td>Dams</td>
<td>Yes</td>
<td>MT, UT, Visual</td>
</tr>
<tr>
<td>Steel Railing</td>
<td>Yes</td>
<td>MT, UT, Visual</td>
</tr>
<tr>
<td>Steel Sign Structures</td>
<td>Yes</td>
<td>MT, UT, [RT][3], Visual</td>
</tr>
<tr>
<td>Bearings (1)</td>
<td>Yes</td>
<td>MT, UT, PT, Visual</td>
</tr>
<tr>
<td>Steel Light Poles</td>
<td>Yes</td>
<td>MT, UT, [RT][3], Visual</td>
</tr>
<tr>
<td>Steel Guide Rail Post</td>
<td>Yes</td>
<td>MT, Visual</td>
</tr>
<tr>
<td>Pedestrian Bridge</td>
<td>Yes</td>
<td>MT, UT, Visual</td>
</tr>
<tr>
<td>Steel Barrier</td>
<td>Yes</td>
<td>MT, UT, Visual</td>
</tr>
<tr>
<td>Machining</td>
<td>Preferred</td>
<td>Visual</td>
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<tr>
<td>Aluminum Barrier (2)</td>
<td>Yes</td>
<td>PT, [UT][3], Visual</td>
</tr>
<tr>
<td>Aluminum Light Poles (2)</td>
<td>Yes</td>
<td>PT, [RT][3], Visual</td>
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<tr>
<td>Aluminum Railing (2)</td>
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<td>Metalizing</td>
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<td>Visual</td>
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<tr>
<td>Galvanizing</td>
<td>Preferred</td>
<td>Visual</td>
</tr>
<tr>
<td>Paint</td>
<td>Preferred</td>
<td>Visual</td>
</tr>
</tbody>
</table>

(1) Experience in Stainless Steel
(2) Experience in Aluminum
(3) NDE certification preferred but not required unless specifically indicated